



New records of marine ornamental shrimps (Decapoda: Stenopodidea and Caridea) from the Gulf of Mannar, Tamil Nadu, India

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Abstract: Marine ornamental shrimps found in tropical coral reef waters are widely recognized for the aquarium trade. Our survey of ornamental shrimps in the Gulf of Mannar, Tamil Nadu (India) has found three species, which we identify as *Stenopus hispidus* Olivier, 1811, *Lysmata debelius* Bruce, 1983, and *L. amboinensis* De Man, 1888, based on morphology and color pattern. These shrimps are recorded for the first time in Gulf of Mannar, Tamil Nadu. Detailed information, including the description of specimens, habitat and distribution, is provided.

Key words: *Stenopus*; *Lysmata*; aquarium trade; distribution

Reef fishes and corals are heavily exploited for the marine aquarium trade. In recent years, invertebrates, including sea anemones, sea stars, sponges, mollusks, crustacean decapods, echinoderms, among others, are gaining popularity among hobbyists (Paulay 1997), along with new developments in marine aquarium technologies. Among invertebrates, decapod crustaceans play an important role in the global marine aquarium industry, in addition to providing ecosystem services (Daily et al. 1997). Of the decapods available on the market, marine ornamental shrimps are most popular (Calado et al. 2003). The reef dwelling caridean shrimps receive the status of being "ornamental" mainly due to their distinctive coloration, bizarre morphology, hardness under captivity, and reef safe (Sprung 2001). Except for the *Stenopus* spp. (family Stenopodidae), most of the shrimps existing in the ornamental trade belong to the major families Palaemonidae, Hippolytidae, and Alpheidae within the Infraorder Caridea (Calado et al. 2003). The destructive collection of caridean shrimps

from coral reefs have greatly affected their diversity and distribution (Wabnitz et al. 2003).

Among all the ornamental shrimps, *Stenopus* spp. and *Lysmata* spp. are the most attractive and extensively traded organisms in the marine aquarium industry (Calado 2008). Interestingly, these shrimps are associates of fishes, in particular, the groupers and giant moray eels (*Gymnothorax* spp.). These shrimps display a cleaning behavior that removes ectoparasites (Becker and Grutter 2004). Along with *Stenopus* and *Lysmata*, a few other species of caridean shrimps (*Periclimenes* spp., *Ancylomenes* spp., *Rhynchocinetes* spp., and *Urocaridella* spp.) are also frequently collected from the Gulf of Mannar to supply for the domestic marine aquarium trade (Prakash 2014; Prakash et al. unpublished data).

In India, freshwater caridean shrimps have been extensively studied (Jayachandran 2001), but a lack of taxonomic knowledge on the coral reef caridean shrimps that have impeded the study. This may be related to the difficulties in working on the fragile reef system and the methodology required to leave the reefs as undisturbed as possible. In recent times, the coral reef-dwelling caridean shrimps of Indian waters are receiving greater attention by researchers in order to understand the taxonomy, biology, and aquaculture aspects (Table 1) (Prakash et al. 2011; Radhakrishnan et al. 2012; Prakash and Ajith Kumar 2013a, 2013b; Prakash et al. 2015; Ajith Kumar et al. 2015; Prakash et al. 2016; Baby et al. 2016). However, the latest checklist of shrimps of the Indian coast (Samuel et al. 2016) omitted many species that are recorded in the literature. In addition, the distribution of a few species and family-level taxonomy are not up to date (Samuel et al. 2016) (see Table 1 for details).

Our surveys off Tuticorin, in the Gulf of Mannar region (India), have revealed the occurrence of three species of ornamental shrimps that are newly recorded

Table 1. List of coral reef caridean and stenopodid shrimps (Decapoda) recently reported from India.

Family (subfamily)	Species	Common name	Distribution records	Reference
Gnathophyllidae	<i>Pycnocaris chagoae</i> Bruce, 1972	Cucumber shrimp	Lakshadweep	Prakash et al. 2011
	<i>Gnathophyllum americanum</i> Guérin-Méneville, 1885	Bumble bee shrimp*	Lakshadweep	Prakash et al. 2015
	<i>Gnathophylloides mineri</i> Schmitt, 1933	Urchin shrimp	Lakshadweep	Prakash et al. 2015
Rhynchocinetidae	<i>Rhynchocinetes durbanensis</i> Gordon, 1936	Hinge beak shrimp*	Gulf of Mannar, Tamil Nadu; Andaman and Nicobar Islands	Prakash and Ajith Kumar 2013a; Subramoniam 2013
Hymenoceridae	<i>Hymenocera picta</i> Dana, 1852	Harlequin Shrimp*	Lakshadweep	Prakash and Ajith Kumar 2013b
Hippolytidae	<i>Thor amboinensis</i> (De Man, 1888)	Squat Shrimp*	Andaman and Nicobar Islands	Subramoniam 2013
	<i>Saron marmoratus</i> (Olivier, 1811)	Marbled Shrimp*	Lakshadweep	Baby et al. 2016
Palaemonidae (Pontoniinae)	<i>Periclimenes brevicarpalis</i> (Schenkel, 1902)	Anemone Shrimp*	Gulf of Kutch; Lakshadweep; Gulf of Mannar	Unmesh and Prakash 2011; Prakash et al. 2015
	<i>Ancylomenes magnificus</i> Bruce, 1979	Anemone Shrimp*	Gulf of Mannar, Tamil Nadu	Prakash et al. 2015
	<i>Periclimenes soror</i> Nobili, 1904	Starfish Shrimp	Lakshadweep	Prakash et al. 2015
	<i>Stegopontonia commensalis</i> Nobili, 1906	Needle Shrimp	Lakshadweep	Prakash et al. 2015
Palaemonidae (Palaemoninae)	<i>Urocaridella</i> sp.	Arrow Cleaner Shrimp*	Gulf of Mannar, Tamil Nadu	Prakash et al. unpublished**
Lysmatidae	<i>Lysmata</i> sp.	Kükenthal's Cleaner Shrimp*	Poombuhaar, Tamil Nadu	Prakash et al. unpublished**
	<i>L. amboinensis</i> (De Man, 1888)	Cleaner Shrimp*	Gulf of Mannar, Tamil Nadu	Present study
	<i>L. debelius</i> Bruce, 1983	Fire Shrimp*	Gulf of Mannar, Tamil Nadu	Present study
Stenopodidae	<i>Stenopus hispidus</i> (Olivier, 1811)	Coral Banded Shrimp*	Lakshadweep; Andaman and Nicobar Islands; Gulf of Mannar, Tamil Nadu	Suresh 1991; Subramoniam 2013; present study

*Species that possess ornamental status

**Yet to be identified

from the study area. They are subsequently identified as *Stenopus hispidus* (Olivier, 1811) (Decapoda: Stenopodidae), *Lysmata debelius* Bruce, 1983 (Caridea: Lysmatidae), and *L. amboinensis* (De Man, 1888) (Caridea: Lysmatidae) (De Grave et al. 2014).

Off the coast of Tuticorin, Gulf of Mannar, Tamil Nadu (India) between February to July 2015, we collected coral reef-dwelling shrimps at depths from 5–20 m by adopting SCUBA diving techniques. The Gulf of Mannar lies between Rameswaram and Tuticorin

and encompasses 21 islands that are run parallel to the coast (Figure 1). The gulf covers an area of 560 km² and is as an exceptionally biodiverse marine ecosystem (Venkataraman and Wafar 2005). Shrimps were gently collected by separating them from giant moray eels using small hooks and fishing nets. Live individuals were immediately packed in air-filled polyethylene bags and transferred to the wet lab facilities at the Centre for Climate Change Studies, Sathyabama University, Chennai, India.

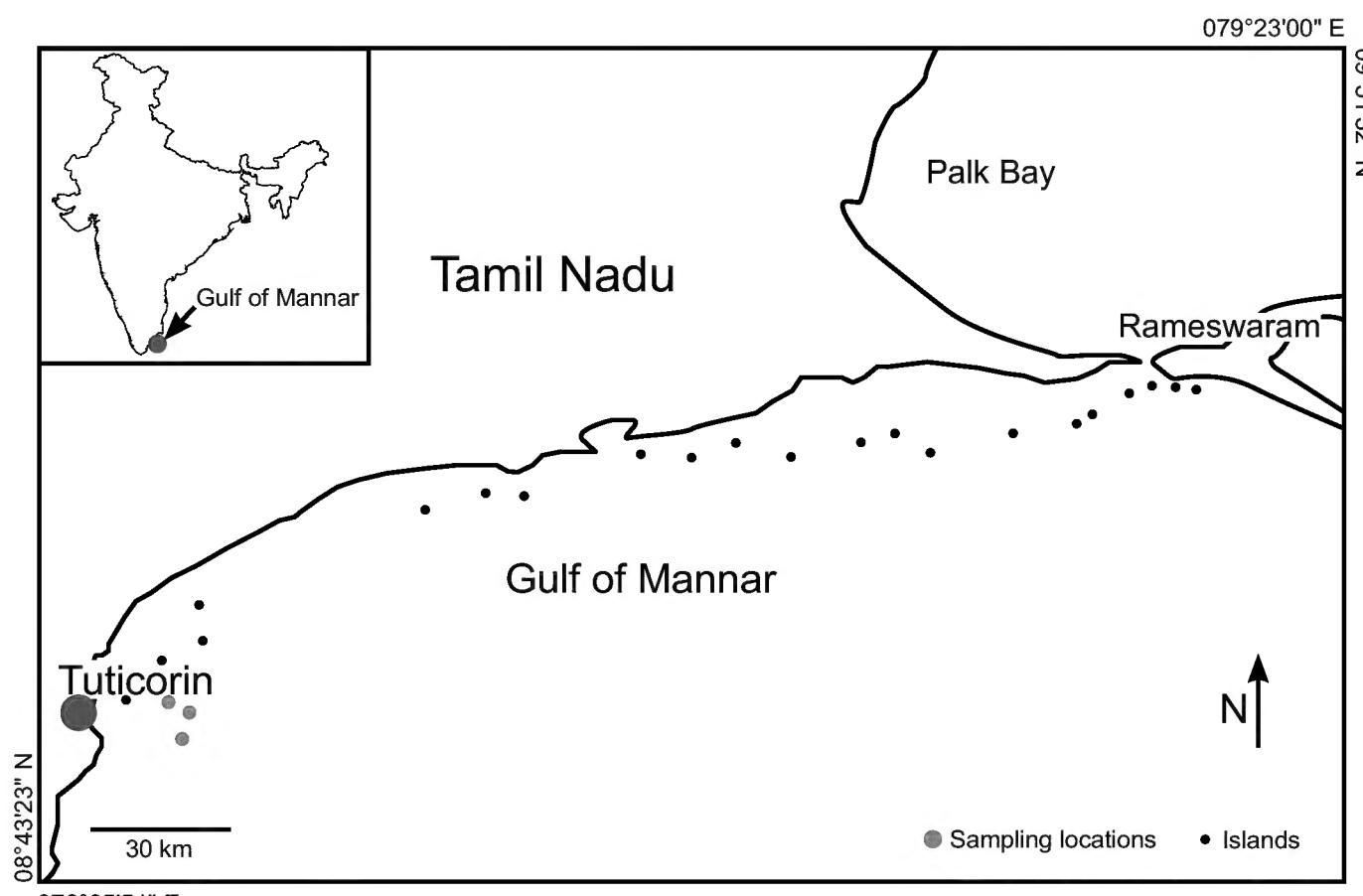


Figure 1. Map showing sampling locations of marine ornamental shrimps collected in the Gulf of Mannar, off the Tuticorin coast (Tamil Nadu, India) and 21 islands that are running parallel to the Gulf of Mannar. Modified from Sundararaju et al. 2012.

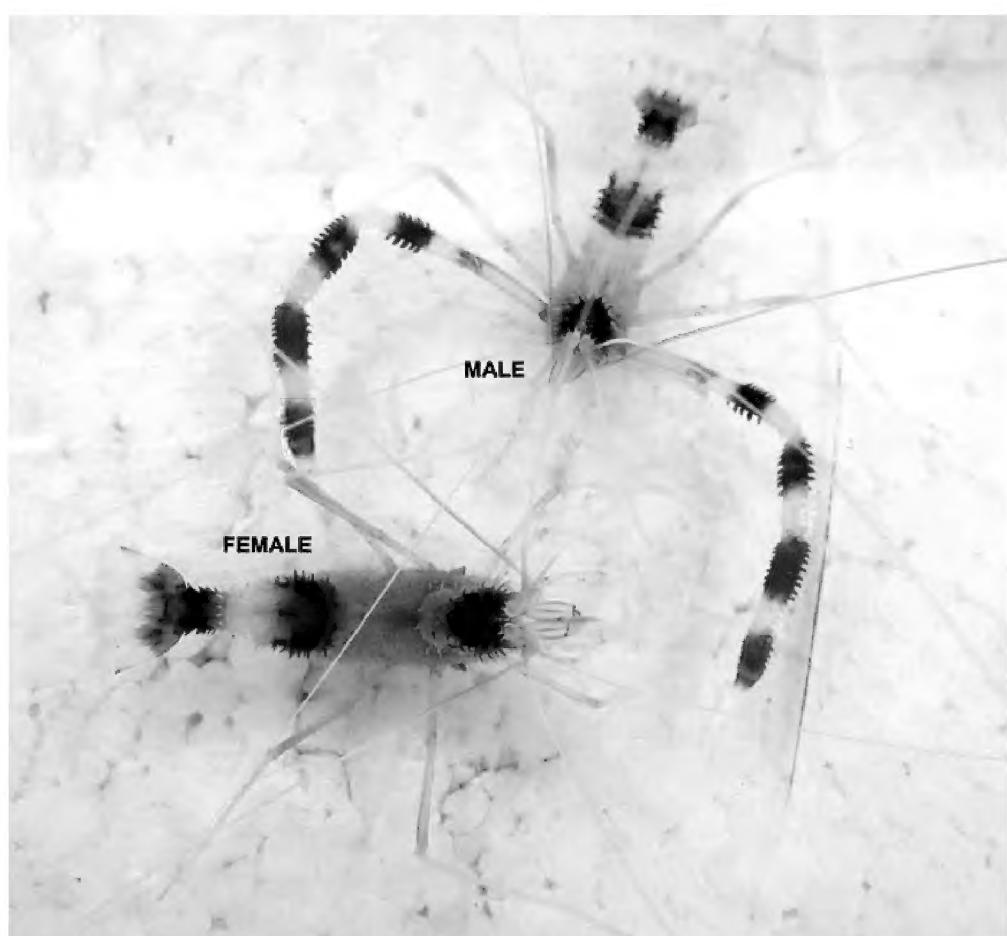


Figure 2. A pair of *Stenopus hispidus* Olivier, 1811, dorsal view, cl 14 and 12 mm, off Tuticorin, depth 15 m, (08°47'07.37" N, 078°23'59.03" E), coll. T.T. Ajith Kumar and S. Prakash, 5 May 2015, ZSI/MBRC/Mi-314.

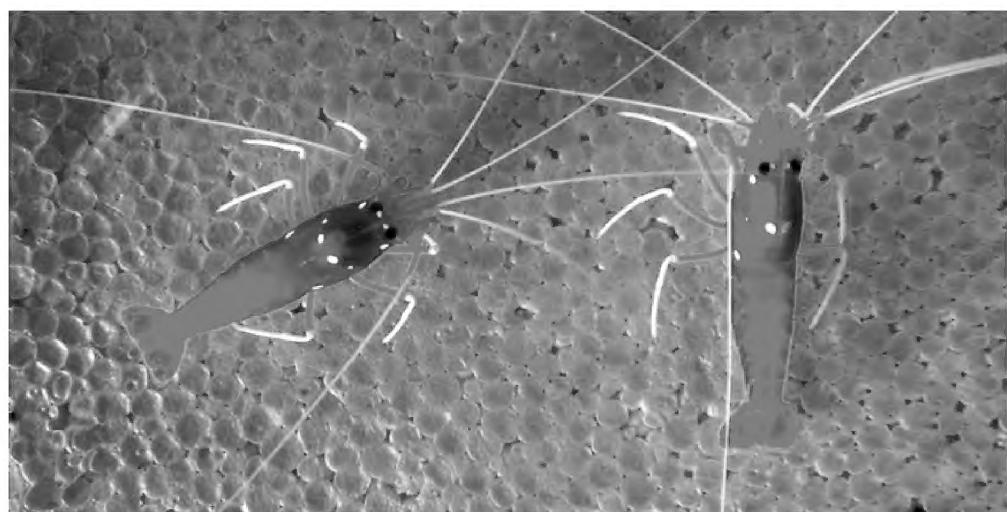


Figure 3. A pair of *Lysmata debelius* Bruce, 1983, dorsal view, cl 14 mm each, off Tuticorin, depth 12–15 m, (08°48'07.41" N, 078°20'30.57" E), coll. S. Prakash, 12 February 2015, ZSI/MBRC/Mi-316.

After transfer, shrimps were acclimatized for 3–4 hours in aquarium tanks circulated with filtered sea water. Photographs of live individuals were taken using Canon G16 digital camera. After acclimation, the individuals were preserved separately in 5–10% seawater-formalin. The preserved specimens were then observed under a Motic SMZ-168 stereo zoom microscope by comparing the key characters of each species based on standard literature. The total length (tl, tip of the rostrum to the posterior end of the telson) and carapace length (cl, the posterior orbital margin to the posterior margin of the carapace) of each shrimp was measured to the nearest to 0.1 mm. Notes on the distribution and ecology are provided for each species. Lastly, the preserved specimens were deposited at the National Zoological Collection of the Marine Biological Regional Centre (MBRC), Zoological Survey of India (ZSI), Chennai, Tamil Nadu as voucher specimens.

***Stenopus hispidus* (Olivier, 1811) (Figure 2)**

Coral-banded Shrimp, Doctor Shrimp, Boxer Shrimp

Palaemon hispidus Olivier (1811): 652–657.

Stenopus hispidus Latreille (1819): 71. — Holthuis (1946): 12; Goy (1992): 100; Goy (2010): 215; De Grave and Fransen (2011): 253; Goy (2015): 335.

Material examined: 2 specimens (1♀ and 1♂) (tl: 51 and 45 mm; cl: 14 and 12 mm), depth 15 m, Gulf of Mannar (off Tuticorin), (08°47'07.37" N, 078°23'59.03" E), coll. T.T. Ajith Kumar and S. Prakash, 5 May 2015, ZSI/MBRC/Mi-314.

Rostrum without lateral spines and not extending to the middle article of antennular peduncle; third abdominal somite with the barred-shield-shaped area. Telson with distinct lateral spines on both the sides. Red and white bands on carapace and abdomen; rostrum red and white; large pereiopods with red and white transverse bands, other pereiopods are white; antennal flagella and maxillipeds white; telson white, uropods red with the terminal white portion.

Our specimens are found in the shallow waters at a depth of 15 m.

Stenopus hispidus is the only species of Stenopodidae known to have a pantropical distribution and is recognized as a symbol of tropical marine biodiversity (Goy 2015). It occurs from the Red Sea and South Africa to Hawaii and the Tuamotu Islands (Limbaugh et al. 1961), Bermuda to Florida, and into the Gulf of Mexico (Zhang et al. 1998; Goy 2015). In India, it was previously reported from Lakshadweep (Suresh 1991) and the Andaman and Nicobar Islands (Subramoniam 2013). Here, we expand its known distribution to include the Gulf of Mannar.

Stenopus hispidus is a widely available ornamental shrimp that has a high market value in the marine aquarium industry (Hair et al. 2004). In India, this shrimp is frequently harvested from the Gulf of Mannar to meet the local demands of marine aquarium hobbyists and entrepreneurs (Prakash et al. unpublished data).

Family Lysmatidae Dana, 1852

Genus *Lysmata* Risso, 1816

***Lysmata debelius* Bruce, 1983 (Figure 3)**

Fire Shrimp, Blood Shrimp, Cleaner Shrimp

Lysmata debelius Bruce (1983): 115, figs. 1–9. — Chace (1997): 74; De Grave and Fransen (2011): 428.

Materials examined: 6♀ (4 ovigerous) (tl 58–64 mm, cl 11–14 mm), depth 12–15 m, Gulf of Mannar (off Tuticorin), (08°48'07.41" N, 078°20'30.57" E), coll. S. Prakash, 12 February 2015, ZSI/MBRC/Mi-316.

Rostrum slender and straight, extending beyond the second antennular peduncle, dorsal carina extending from the middle of carapace with five sharp spines,

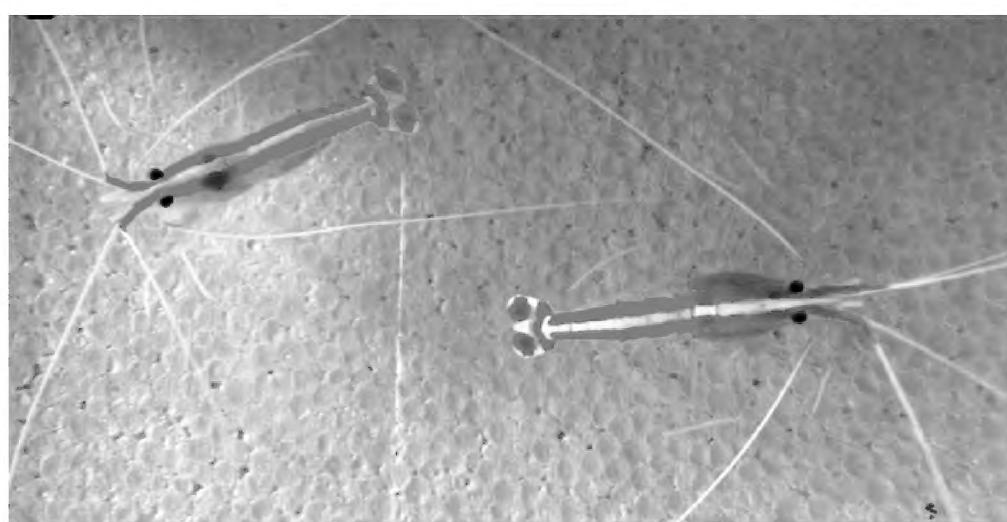


Figure 4. A pair of *Lysmata amboinensis* De Man, 1888, dorsal view, cl 12 and 13 mm, off Tuticorin, depth 6–8 m, (08°43'56.25" N, 078°24'42.07" E), coll. S. Prakash, 15 July 2015, ZSI/MBRC/Mi-315.

eyes short and stout with the deeply pigmented cornea. Antennular peduncle strong with acute stylocerite, accessory flagellum with small protrusion; antenna with strong ventrolateral spine; third maxilliped slender and extending beyond the scaphocerite; first pereiopods strong extending beyond scaphocerite, chela robust, fingers short and stout; second pereiopods unequal, long and slender; third pereiopods slender extending beyond scaphocerite, dactyl short, strong and compressed; fourth and fifth pereiopods similar; pleopods are long slender. Uniform deep red color on carapace including rostrum, chelipeds, ambulatory legs and pleopods. The presence of brilliant white on propodi and dactyl of ambulatory legs, large circular white spots on cephalothorax and epistome, small white spots centrally on exopods of pleopods.

We found this species associated with giant moray eels (*Gymnothorax* sp.) in crevices between large boulders.

Lysmata debelius has a circumtropical distribution and is throughout the Indo-Pacific (Bruce 1983). We record this species for the first time from Indian waters. *Lysmata debelius* may be confused, due to similar coloration, with *L. splendida*, which is known only from its type locality at Ary Atoll, Maldives (Burukovski 2000). Specimens displaying large white dots on the dorsal surface are *L. splendida*.

Genus *Lysmata* Risso, 1816

***Lysmata amboinensis* (De Man, 1888) (Figure 4)**

Scarlet Cleaner Shrimp, Skunk Cleaner Shrimp

Hippolysmata vittata var. *amboinensis* De Man, 1888: 495.

Hippolysmata (Hippolysmata) amboinensis Holthuis (1947): 70, figs. 12–14.

Lysmata grabhami Bruce (1974): 107, pl. 1, not *Hippolysmata grabhami* Gordon, 1935.

Lysmata amboinensis Hayashi (1975b): 286, figs. 1–4, pl. 5 [in part].

— Debelius (1984): 112; Manning and Chace (1990): 112; Chace (1997): 74; De Grave and Fransen (2011): 428.

Material examined: 5 ♀ (2 ovigerous) (tl 55–62 mm; cl 11–13 mm), depth 6–8 m, Gulf of Mannar (off Tuticorin), (08°43'56.25" N, 078°24'42.07" E), coll. S. Prakash, 15 July 2015, ZSI/MBRC/Mi-315.

Rostrum not reaching over the antennular peduncle; carapace with pterygostomian tooth. Stylocerite of antennules short, not reach the mid-length of basal segment, dorsal flagellum without accessory branch; antennal scale slightly reaching beyond the end of antennular peduncle, distolateral tooth overreaching the blade. Third maxilliped with the antepenultimate segment. First pereiopod with chela slightly larger than the carpus, second pereiopod with carpus composed of 19 articles, third pereiopod with dactyl biunguiculate. It also displays large and conspicuous white antennae and a white third pair of maxillipeds. Legs and bodies are bright yellow, with a longitudinal stripe running from head to tail on the dorsal surface, bordered on each side by a blood-red longitudinal stripe.

We collected specimens in association with large groupers and eels at a depth of 6–8 m.

Lysmata amboinensis occurs in the Red Sea, Mombasa, Gulf of Tonkin, Okinawa, Japan, Philippines, and Indonesia to Hawaii and the Society Islands (Chace 1997). We extend the known distribution to include the Gulf of Mannar.

Lysmata amboinensis is often confused with *L. grabhami* due to their similar coloration. In *L. amboinensis*, the longitudinal white stripes on the telson are discontinuous and form an inverted white triangle in the posterior portion of the body segment and each external branch of the uropods displays two distinctive patches. In *L. grabhami*, the longitudinal white line is continuous from the rostrum to telson and each external branch of the uropods displays a continuous white line on the outer margins.

Although, marine ornamental shrimps are occurring in all tropical oceans, the most diversity is seen only throughout the Indo-Pacific (De Grave and Fransen 2011). Severe depletion of populations due to aquarium trade, as well as habitat loss in recent decades has brought the conservation of biodiversity to the forefront (Wabnitz et al. 2003). Therefore, detailed study on the taxonomy, reproductive biology and conservation of marine ornamental shrimps of the coral reef regions of peninsular India is much warranted. Recent studies have addressed the sexual and mating systems of a few species of ornamental shrimps from Andaman and Gulf of Mannar regions (Subramoniam 2013; Prakash 2014; Prakash et al. 2016). Hence, future studies on these caridean shrimps are necessary to understand the diverse life histories and adaptations and provide increased insight into the social interactions with other coral reef-dwelling organisms.

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